

**AMENDMENTS TO THE CLAIMS**

**Listing of Claims:**

This listing of claims will replace all prior version, and listings, of claims in the application:

Claim 1 (Previously Presented): An image processing method comprising:

- a determination step of determining a plurality of areas, each of which includes a plurality of pixels, arranged in a direction on an image;
- a representative value calculation step of calculating a representative value determined in regard of each of said plurality of areas, from a pixel value of each area;
- a density gradient calculation step of calculating a value concerning a first order differential value from each combination of the two representative values in the representative values calculated in said representative value calculation step;
- an evaluation step of calculating a value representing an irradiation end from each combination of the values concerning the first order differential value in the values concerning the first order differential value calculated in said density gradient calculating step; and
- a judgment step of judging an edge point of an irradiation area from the value representing the irradiation end calculated in said evaluation step.

Claim 2 (Previously Presented): A method according to Claim 1, further comprising a step of extracting the irradiation area from a plurality of edge points obtained in said obtaining step.

Claim 3 (Previously Presented): A method according to Claim 1, wherein each of the values representing different one of the plurality of areas is an average value of pixel values in the corresponding area.

Claim 4 (Previously Presented): A method according to Claim 1, wherein each of the values representing different one of the plurality of areas is a median value of pixel values in the corresponding area.

Claim 5 (Previously Presented): A method according to Claim 1, wherein each of the values representing different one of the plurality of areas is an average value of a limited number of pixel values in the corresponding area.

Claim 6 (Previously Presented): A method according to Claim 1, wherein each of the values representing different one of the plurality of areas is a median value of a limited number of pixel values in the corresponding area.

Claim 7 (Previously Presented): A method according to Claim 1, wherein each of the values representing different one of the plurality of areas is calculated by integrating pixel values in a direction in the corresponding area.

Claim 8 (Previously Presented): A method according to Claim 1, wherein each of the values representing different one of the plurality of areas is obtained by smoothing pixel values in the corresponding area.

Claim 9 (Previously Presented): An image processing method comprising:  
a detecting step of calculating candidates for edge points of an irradiation area from an image area;

an evaluating step of calculating an evaluation value for evaluating positional relations among coordinates of the candidates for the edge points of the irradiation area calculated in said detecting step or positional relations between a predetermined coordinate and the coordinates of the candidates for the edge points of the irradiation area; and

a judging step of judging whether photographing is performed by an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm, based on the evaluation value calculated in said evaluating step.

Claims 10-22 (Canceled)

Claim 23 (Previously Presented): An image processing apparatus, comprising:

determination means for determining a plurality of areas, each of which includes a plurality of pixels, arranged in a direction on an image;

representative value calculation means for calculating a representative value determined in regard of each of said plurality of areas, from a pixel value of each area;

density gradient calculation means for calculating a value concerning a first order differential value from each combination of the two representative values in the representative values calculated by said representative value calculation means;

evaluation means for calculating a value representing an irradiation end from each combination of the values concerning the first order differential value in the values concerning the first order differential value calculated by said density gradient calculating means; and

judgment means for judging an edge point of an irradiation area from the value representing the irradiation end calculated by said evaluation means.

Claim 24 (Previously Presented): An image processing apparatus comprising:

detecting means for calculating candidates for edge points of an irradiation area from an image area;

evaluating means for calculating an evaluation value for evaluating positional relations among coordinates of the candidates for the edge points of the irradiation area calculated by said detecting means or positional relations between a predetermined coordinate and the coordinates of the candidates for the edge points of the irradiation area; and

judging means for judging whether photographing is performed by an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm, based on the evaluation value calculated by said evaluating means.

**Claim 25 (Canceled)**

**Claim 26 (Previously Presented):** A computer-readable storage medium storing a program for making a computer execute an image processing method, said method comprising:

a determination step of determining a plurality of areas, each of which includes a plurality of pixels, arranged in a direction on an image;

a representative value calculation step of calculating a representative value determined in regard of each of said plurality of areas, from a pixel value of each area;

a density gradient calculation step of calculating a value concerning a first order differential value from each combination of the two representative values in the representative values calculated in said representative value calculation step;

an evaluation step of calculating a value representing an irradiation end from each combination of the values concerning the first order differential value in the values concerning the first order differential value calculated in said density gradient calculating step; and

a judgment step of judging an edge point of an irradiation area from the value representing the irradiation end calculated in said evaluation step.

Claim 27 (Previously Presented): A computer-readable storage medium storing a program for making a computer execute an image processing method, said method comprising:

a detecting step of calculating candidates for edge points of an irradiation area from an image area;

an evaluating step of calculating an evaluation value for evaluating positional relations among coordinates of the candidates for the edge points of the irradiation area calculated in said detecting step or positional relations between a predetermined coordinate and the coordinates of the candidates for the edge points of the irradiation area; and

a judging step of judging whether photographing is performed by an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm based on the evaluation value calculated in said evaluating step.

Claim 28-31 (Canceled)

Claim 32 (Previously Presented): A method according to claim 9, wherein said detection step comprises:

a step of determining a plurality of areas, each of which including a plurality of pixels, arranged in a direction on an image;

a step of calculating second order difference values from values each of which represents different one of the plurality of areas; and

a step of obtaining an end point of an irradiation area from the second order difference values calculated in said calculation step.

Claim 33 (Previously Presented): A method according to Claim 9, wherein in said evaluation step, variance of positions of edge points detected in said detection step is calculated.

Claim 34 (Canceled)

Claim 35 (Previously Presented): A method according to Claim 9, wherein in said evaluation step, whether positions of edge points detected in said detection step are close to each other is evaluated.

Claim 36 (Canceled)

Claim 37 (Previously Presented): A method according to Claim 9, wherein said evaluation step comprises:

a step of comparing an average position of positions of edge points detected in said detection step with a predetermined position.

Claim 38 (Previously Presented): A method according to Claim 37, wherein said evaluation step further comprises:

a step of calculating variance of positions of edge points detected in said detection step, in accordance with a comparison result in said comparison step.

Claim 39 (Previously Presented): A method according to Claim 32, wherein in said obtaining step, the edge point is obtained from the second order difference values and signs of first order difference values calculated from the values each of which represents different one of the plurality of areas.

Claim 40 (Canceled)

Claim 41 (Previously Presented): A method according to Claim 1, wherein, in said evaluation step, a second order differential value is used as the value representing the irradiation end.

Claim 42 (New): An image processing method according to claim 1, wherein  
in said density gradient calculation step, the first order differential value is calculated from each combination of the adjacent representative values in the representative values calculated in said representative value calculation step; and  
in said evaluation step, a second order difference value is calculated as a value representing an irradiation end from each combination of the adjacent first order differential values, in the first order differential values calculated in said density gradient calculating step.



Claim 43 (New): An image processing method comprising:

a detection step of calculating candidates for edge points of an irradiation area from an image area;

an evaluation step of calculating an evaluation value for evaluating positional relations among coordinates of the candidates for the edge points of the irradiation area calculated in said detection step or positional relations between a predetermined coordinate and the coordinates of the candidates for the edge points of the irradiation area; and

a judgment step of judging whether or not photographing is performed by using an irradiation diaphragm based on the evaluation value calculated in said evaluating step.

Claim 44 (New): An irradiation image pickup apparatus having an irradiation area extraction function, comprising:

X-ray irradiation means having an irradiation diaphragm function for irradiating a radiant ray including an X-ray;

a sensor for converting the X-ray irradiated by said X-ray irradiation means into a radiographic image signal;

determination means for determining a plurality of areas, each of which includes a plurality of pixels, arranged in a direction of the radiographic image signal input by said sensor;

representative value calculation means for calculating a representative value determined in regard of each of said plurality of areas, from a pixel value of each area;

density gradient calculation means for calculating a value concerning a first order differential value from each combination of the two representative values in the representative values calculated by said representative value calculation means;

evaluation means for calculating a value representing an irradiation end from each combination of the values concerning the first order differential value, in the values concerning the first order differential calculated by the said density gradient calculation means, and

judgment means for judging an edge point of an irradiation area from the value representing the irradiation end calculated by said evaluation means.

Claim 45 (New): An X-ray image pickup apparatus which is equipped with an image discrimination apparatus of judging whether or not photographing is performed by using an irradiation diaphragm, comprising:

X-ray irradiation means having an irradiation diaphragm function for irradiating a radiant ray including an X-ray;

a sensor for converting the X-ray irradiated by said X-ray irradiation means into a radiographic image signal;

detection means for calculating candidates for edge points of an irradiation area from the radiographic image signal input by said sensor;

evaluation means for calculating an evaluation value for evaluating positional relations among coordinates of the candidates for the edge points of the irradiation area

calculated in said detection means or positional relations between a predetermined coordinate and the coordinates of the candidates for the edge points of the irradiation area; and

judgment means for judging whether or not photographing is performed by using the irradiation diaphragm based on the evaluation value calculated in said evaluation means.